REMARKS

The application includes claims 1-12, in which claims 6-11 were withdrawn from consideration. Claims 1 and 12 are amended, none are added and none are canceled.

Claim Rejections under 35 USC §103

At page 2, section 2 of the Office Action, claims 1-5 and 12 are rejected under 35 USC §103(a) as being unpatentable over Shuji *et al* (Japanese Patent Publication No. 01-156,597, referred to as Shuji hereinafter).

At page 2, section 3 of the Office Action, claims 1, 4 and 5 are rejected under 35 USC §103(a) as being unpatentable over Shuji taken alone or in further view of Tomizawa *et al* (U.S. Patent No. 6,224,971, referred to as Tomizawa hereinafter).

Currently amended claim 1 recites a recording medium having a coating layer on the surface of a substrate. The coating layer comprises: (A) a polyvinyl alcohol resin containing an acetoacetic ester group (abbreviated as AAPVA), (B) a zirconium compound, and (C) amorphous synthetic silica having an average particle size of 0.01 to 20 μm.

Shuji discloses a paper-coating agent containing an acetoacetate ester group-containing PVA-based resin and a zirconium salt. Shuji does not, however, disclose the inclusion of an inorganic powder, particularly amorphous synthetic silica having an average particle size of 0.01 to 20 μm. The inclusion of this particular material would not have been obvious to one of ordinary skill in the art.

It is known in the art to add an inorganic powder in a coating agent for improving the properties of the coating. The roles of the inorganic powder include acting as a matting agent, affecting visual properties like brightness, or increasing absorption of the surface. However, the selection of an inorganic powder particularly for providing some desired properties of the coating, i.e. a strong surface, no ink blurring when printing and an excellent water resistance, is not commonly known.

In the instant application, it is shown that different inorganic materials added in the coating solution resulted in different peeling strength, blurring and water resistance of the formed coating layer. The amorphous synthetic silica having an average particle size of 0.01 to 20 μm is particularly favored over other materials. In the Examples of the instant

specification, it is shown that by adding the zirconium compound and the amorphous synthetic silica having an average particle size of 0.01 to 20 μm to the AAPVA, the surface strength of the coating surface is strong, ink blurring when printing hardly occurs, particularly when used for ink jet printing, and water resistance after printing is excellent. The beneficial effects of adding the amorphous synthetic silica to the recording medium are demonstrated by comparing the Example 1 (with the formula as recited in claim 1) with Comparative Example 1 (no zirconium compound) and Comparative Example 2 (no inorganic powder); and by comparing the Example 3 (with the formula as recited in claim 1) with Comparative Example 3 (no zirconium compound) and Comparative Example 4 (no inorganic powder). The experiment results are summarized in Tables 1 and 2, in which it is shown that the recording mediums of Example 1 and 3 are excellent in the peel strength, blurring and water resistance.

Moreover, the above effects achieved by adding the amorphous synthetic silica having an average particle size of 0.01 to 20 μm to the recording medium cannot be accomplished by adding an alternative inorganic power such as colloidal silica, even if the other inorganic powder has a similar composition and particle size. As shown in a Declaration under 37 CFR §1.132 filed with this paper, an experiment comparing the recording medium with the inorganic powder (C) of claim 1 (amorphous synthetic silica having an average particle size of 0.01 to 20 μm) with the recording medium with an alternative inorganic powder (colloidal silica having an average particle size of 0.022 μm) shows that the later has a poor membrane-formability and many cracks on the surface.

Therefore, the present invention provides a recording medium having a coating layer comprising AAPVA, a zirconium compound and the amorphous synthetic silica having the average particle size of 0.01 to 20 μm. With the application of such a coating layer, the surface strength of the coating surface is strong, ink blurring when printing hardly occurs and water resistance after printing is excellent.

This excellent effect obtained by using the amorphous synthetic silica can be explained by the difference in average particle size between the amorphous synthetic silica and other inorganic powders such as the colloidal silica.

Compared to the average particle size of the amorphous synthetic silica, the average particle size of the colloidal silica (generally 0.01 to 0.1 μm) is much smaller. Thus, the

specific surface area of the colloidal silica is much larger than that of the amorphous synthetic silica. Therefore, if the colloidal silica is used, it is necessary to increase the percentage of the binder (AAPVA) in the coating solution in order to cover the surface of the colloidal silica particles for providing sufficient adhesion strength.

Generally, in order to form an ink receipt layer on a substrate as an ink-jet recording medium, it is desired the coating solution containing as much as possible the pigment dispersed in as little as possible the binder. For a certain amount of binder (e.g. 100 parts of AAPVA for 333 parts of inorganic powder, as in the experiment described in the Declaration), when the amorphous synthetic silica is used as the inorganic powder, cracks do not occur because the average particle size of the amorphous synthetic silica (generally 1 to 15 μm) is large and the amount of the binder is sufficient.

On the other hand, when the colloidal silica is used, because of the larger specific surface, the same amount of the binder that is sufficient for the amorphous synthetic silica becomes insufficient for the colloidal silica. As a result, cracks are developed in the coating layer comprising the zirconium compound and the colloidal silica.

The above results achieved by using the amorphous synthetic silica as the inorganic particle in the coating layer is not disclosed in any of the prior art reference documents cited by the Office.

Among the cited references, Shuji describes a paper processing agent comprising an aqueous solution containing an acetoacetate ester group-containing polyvinyl alcohol resin and a zirconium salt, having a remarkably long pot life and giving a paper a high rigidity. However, Shuji does not disclose the inclusion of any inorganic powder.

Tomizawa discloses an ink-jet recording sheet comprising a substrate and an ink-receptive coating on at least one surface of the substrate formed by coating with a liquid coating composition comprising an acetoacetylated polyvinyl alcohol, a polyvinlpyrrolidone resin and an acidic aqueous dispersion of a colloidal silica. In Tomizawa, the colloidal silica is an essential component and other types of silica are not used in Examples of Tomizawa. Amorphous synthetic silica is neither described nor suggested.

The Office further cites two references (JP10-119423 and JP10-217601) mentioned in Nakano *et al* (U.S. Patent Application Publication No. 2003/0186003) for teaching the

inclusion of inorganic particles in a recording layer of an ink jet recording paper, but neither of these two references discloses that the inorganic particles are amorphous synthetic silica having an average particle size of 0.01 to 20 μm.

Therefore, none of the above references describe or suggest the use of the amorphous synthetic silica and none of them showed the excellent effects achieved by adding the zirconium compound and the amorphous synthetic silica to AAPVA. Consequently, the present invention cannot be achieved by combining Shuji and Tomizawa, or combining all the above-mentioned references.

Based on the above reasons, applicant respectfully requests that the rejection of claim 1 under 35 USC §103(a) be reconsidered and withdrawn.

Claims 2-5 depend on claim 1. Claim 12 recites a recording medium for ink jet printing having a coating layer with the same composition as claim 1. Accordingly, applicant also requests rejections of claims 2-5 and 12 be reconsidered and withdrawn.

Conclusion

For all the foregoing reasons it is believed that all remaining claims of the application are in condition for allowance, and their passage to issue is earnestly solicited. Applicant's agent welcomes the Examiner to call if anything in the present response is unclear or unpersuasive.

Respectfully submitted,

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Date

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